Claims

Please cancel claims 4-10, 37-41, 45 and 59-64 without prejudice. Applicants reserve the right to file continuing applications directed to the subject matter of the canceled claims.

1. (Previously presented) A method for making a device or a component of a device, comprising:

providing plural laminae made from a non-thin film metal or metal alloy and stacked to define internal laminae positioned between external laminae, the plural laminae coupled together collectively defining a monolithic device or a component of a device, at least one of the internal lamina having at least one structure, at least one substructure, and at least one fixture bridge, the structure and the substructure defining a space therebetween, and further with the substructure being coupled to the structure by the fixture bridge across the space; and

dissociating the substructure by applying an electrical current across the fixture bridge sufficient to eliminate the fixture bridge.

2. (Original) The method according to claim 1 where at least one lamina includes plural substructures and at least one substructure is coupled to at least one other substructure by a fixture bridge.

Claims 3 – 10 (Canceled).

11. (Original) The method according to claim 1 whereby dissociating the substructure from the structure by eliminating the fixture bridge comprises:

placing a first electrode on a first substructure to be dissociated;

contacting a structure or substructure coupled to the first substructure with a second electrode; and

applying a current through the first and second electrodes.

12. (Original) The method according to claim 11where at least one of the first and second electrodes comprises a graphite tip.

13. (Original) The method according to claim 1 further, comprising:

registering the plural laminae; and

bonding the plural laminae one to another to form a monolithic device prior to or subsequent to eliminating at least one fixture bridge.

14. (Original) The method according to claim 13 whereby the method of bonding the plural laminae one to another to form a monolithic device is diffusion bonding, diffusion soldering, thermal brazing, adhesive bonding, thermal adhesive bonding, curative adhesive bonding, electrostatic bonding, microprojection welding, resistance welding, or combinations of these methods.

Claims 15 – 17 (Canceled).

18. (Original) The method according to claim 1 whereby making the device further comprises utilizing fabrication technologies selected from the group consisting of additive freeform fabrication, rapid prototyping, microlamination, metal microlamination, and micromechanical fabrication.

19. (Original) The method according to claim 1 whereby the manner of forming at least one lamina is selected from the group consisting of micromachining, laser photoablation, chemical micromachining, electrochemical micromachining, and through-mask electrochemical micromachining.

20. (Original) The method according to claim 1 whereby the manner of forming at least one lamina includes lamina preparation.

21. (Original) The method according to claim 20 whereby the method of lamina preparation is selected from the group consisting of chemical etching, acid etching, electropolishing, oxide-free coating, and combinations thereof.

22. (Original) The method according to claim 1 where at least one of the lamina is made from a material selected from the group consisting of metals, metal alloys, polymers, ceramics, composites, stainless steel, carbon steel or phosphor bronze, and mixtures thereof.

23. (Withdrawn) The method according to claim 1 where at least one of the lamina is made from stainless steel, carbon steel or phosphor bronze.

24. (Original) The method according to claim 1 where the device is selected from the group consisting of micromechanical systems, microelectromechanical systems, miniature energy and chemical systems, microthermal systems, microthermomechanical systems, cryocoolers, alpha-Stirling coolers, heat pumps, compressors, thermal compressors, refrigerators, heat engines, valves, nozzled valves, ink-jet print-head valves, fuel cells, fuel combustors, fuel processors, and systems comprising one or more of these devices.

25. (Original) The method according to claim 1 where the device includes at least one high-aspect-ratio microchannel having a height-to-width ratio of at least 20:1.

26. (Original) The method according to claim 1 where the device is micro-scale.

27. (Original) The method according to claim 1 where the device is meso-scale.

28. (Previously presented) A method for making a micro- or meso-scale device or a component of such a device comprising:

providing three or more laminae made from a non-thin film metal or metal alloy that coupled together collectively define a device or a component of a device;

registering the laminae to define at least one internal lamina, positioned between a first and a second lamina, the at least one internal lamina having a structure and at least one substructure coupled to the structure or another substructure by at least one fixture bridge;

bonding the laminae one to another to form a monolithic device or a component of a device; and

eliminating the fixture bridge prior or subsequent to bonding the laminae by applying an electrical current across the fixture bridge.

29. (Previously presented) The method according to claim 28 where the structure and substructure were formed by laser micromachining photochemical micromachining, electrochemical micromachining, or combinations of these methods.

30. (Withdrawn) The method according to claim 29 where bonding comprises microprojection welding.

31. (Withdrawn) The method according to claim 29 where bonding comprises diffusion soldering.

32. (Withdrawn) The method according to claim 31 where diffusion soldering comprises using layers comprising copper, silver, tin, indium and combinations and mixtures thereof.

33. (Canceled).

34. (Previously presented) A method for making an array of devices or an array of components of devices, comprising:

providing plural laminae made from a non-thin film metal or metal alloy where at least one of the plural lamina has an array of at least two assemblies, each assembly in the array comprising at least one structure, at least one substructure, and at least one fixture bridge, such that at least one of the structures and at least one of the substructures define a space therebetween, and at least one substructure is coupled to at least one structure by at least one fixture bridge across the space;

registering the laminae to define at least one internal lamina, positioned between a first and a second lamina; and

dissociating at least one substructure of an internal lamina from the structure to which it is coupled by applying an electrical current across the fixture bridge sufficient to eliminate the fixture bridge, thereby making an array of devices or an array of components of devices.

35. (Canceled).

36. (Previously presented) The method according to claim 34 where dissociating each substructure from its coupled structure by eliminating the fixture bridge comprises applying an electrical current across the fixture bridge sufficient to eliminate the fixture bridge.

Claims 37 – 41 (Canceled).

42. (Previously presented) The method according to claim 34 where dissociating the substructures from structures by eliminating fixture bridges comprises:

placing an electrode on each substructure to be dissociated;

contacting the structure, coupled to the substructure with a second electrode; and

applying a current through the electrodes.

43. (Previously presented) The method according to claim 34 further comprising:

registering the plural laminae; and

bonding the plural laminae one to another to form an array of monolithic devices.

44. (Previously presented) The method according to claim 43 where the manner of bonding the plural laminae one to another to form an array of monolithic devices is selected from the group consisting of diffusion soldering, diffusion bonding, thermal brazing, adhesive bonding, thermal adhesive bonding, curative adhesive bonding, electrostatic bonding, microprojection welding, resistance welding, and combinations thereof.

45. (Canceled).

46. (Previously presented) The method according to claim 34 where dissociating a substructure from the structure to which it is coupled by eliminating the fixture bridge(s) is performed before the plural laminae are registered and bonded.

Claims 47 – 49 (Canceled).

50. (Previously presented) The method according to claim 34 where the manner of forming the plural laminae is selected from the group consisting of additive freeform fabrication, rapid prototyping, microlamination, metal microlamination, and micromechanical fabrication.

51. (Previously presented) The method according to claim 34 where the manner of forming the array of structures and coupled substructures is selected from the group consisting of micromachining, laser photoablation, chemical micromachining, electrochemical micromachining, and through-mask electrochemical micromachining.

52. (Previously presented) The method according to claim 34 where forming the array of structures and coupled substructures includes lamina preparation.

53. (Previously presented) The method according to claim 52 where the manner of lamina preparation is selected from the group consisting of chemical etching, acid etching, electropolishing, oxide- free coating, and mixtures thereof.

54. (Previously presented) The method according to claim 34 where at least one of the lamina is made from a material selected from the group consisting of metals, polymers, ceramics, composites, stainless steel, carbon steel, phosphor bronze, metal alloys, and mixtures thereof.

55. (Previously presented) The method according to claim 34 where the device is selected from the group consisting of micromechanical systems, microelectromechanical systems, miniature energy and chemical systems, microthermal systems, microthermomechanical systems, cryocoolers, Stirling cycle cryocoolers, heat pumps, compressors, thermal compressors,

refrigerators, heat engines, valves, nozzled valves, ink jet print head valves, fuel cells, fuel combustors, fuel processors, and systems comprising one or more of these devices.

56. (Previously presented) The method according to claim 34 where the device includes at least one high-aspect-ratio microchannel with a ratio of height-to-width of at least 20:1.

57. (Previously presented) The method according to claim 34 where the size of the device is microscale.

58. (Previously presented) The method according to claim 34 where the size of the device is meso-scale.

Claims 59 – 64 (Canceled).

65. (Previously presented) A method for making a device or a component of a device, comprising:

providing plural laminae that coupled together collectively define a monolithic device or a component of a device, at least one of the lamina having at least one structure, at least one substructure, and at least one fixture bridge, the structure and the substructure defining a space therebetween, and further with the substructure being coupled to the structure by the fixture bridge across the space;

registering the plural laminae;

filling the space between the structure and the substructure with a fixative prior to eliminating at least one fixture bridge;

dissociating the substructure by eliminating the fixture bridge;

eliminating the fixative; and

bonding the plural laminae one to another to form a monolithic device or a component of a device prior to or subsequent to eliminating at least one fixture bridge.

66. (Previously presented) The method according to claim 65 where the fixative is a wax.

67. (Previously presented) The method according to claim 65 where eliminating the fixative comprises heating the fixative.

68. (Previously presented) The method according to claim 65 where the plural laminae define a subsection of a device, and further comprising registering the subsection with at least one additional lamina subsequent to eliminating the fixative.

69. (Previously presented) The method according to claim 68 further comprising registering the subsection with plural additional lamina subsequent to eliminating the fixative.

70. (Previously presented) A method for making an array of devices or an array of components of devices, comprising:

providing plural laminae where at least one of the plural lamina has an array of at least two assemblies, each assembly in the array comprising at least one structure, at least one substructure, and at least one fixture bridge, such that at least one of the structures and at least one of the substructures define a space therebetween, and at least one substructure is coupled to at least one structure by at least one fixture bridge across the space;

filling the space between each structure and its coupled substructure with a fixative prior to eliminating the fixture bridge;

dissociating at least one substructure from the structure to which it is coupled by eliminating the fixture bridge(s), thereby making an array of devices or an array of components of devices, where dissociating each substructure from the structure to which it is coupled by eliminating the fixture bridge(s) is performed before the plural laminae are registered and bonded; and

eliminating the fixative.

71. (Previously presented) The method according to claim 70 wherein the fixative is wax.

72. (Previously presented) The method according to claim 70 whereby the fixative is eliminated by heating.

73. (Previously presented) A method for making a device or a component of a device, comprising:

providing plural laminae that coupled together collectively define a monolithic device or a component of a device, at least one of the lamina having at least one structure, at least one substructure, and at least one fixture bridge made of a non-refractory material, the structure and the substructure defining a space therebetween, and further with the substructure being coupled to the structure by the fixture bridge across the space; and

dissociating the substructure by eliminating the fixture bridge.

74. (Previously presented) The method according to claim 73 where the fixture bridge consists essentially of at least one metal or metal alloy.

75. (Previously presented) The method according to claim 73 where at least one lamina includes plural substructures and at least one substructure is coupled to at least one other substructure by a fixture bridge.

76. (Previously presented) The method according to claim 73 whereby dissociating the substructure by eliminating at least one fixture bridge comprises applying an electrical potential across the fixture bridge sufficient to eliminate the fixture bridge.

77. (Previously presented) The method according to claim 73 whereby dissociating the substructure from the structure by eliminating the fixture bridge comprises:

placing a first electrode on a first substructure to be dissociated;

contacting a structure or substructure coupled to the first substructure with a second electrode; and

applying a current through the first and second electrodes.

78. (Previously presented) The method according to claim 77 where at least one of the first and second electrodes comprises a graphite tip.

79. (Previously presented) The method according to claim 73 further, comprising:

registering the plural laminae; and

bonding the plural laminae one to another to form a monolithic device prior to or subsequent to eliminating at least one fixture bridge.

80. (Previously presented) The method according to claim 79 whereby the method of bonding the plural laminae one to another to form a monolithic device is diffusion bonding, diffusion soldering, thermal brazing, adhesive bonding, thermal adhesive bonding, curative adhesive bonding, electrostatic bonding, microprojection welding, resistance welding, or combinations of these methods.

81. (Previously presented) The method according to claim 79 further comprising:

filling the space between the structure and the substructure with a fixative prior to eliminating at least one fixture bridge; and

eliminating the fixative.

82. (Previously presented) The method according to claim 81 where the fixative is a wax.

83. (Previously presented) The method according to claim 81 where eliminating the fixative comprises heating the fixative.

84. (Previously presented) The method according to claim 73 where at least one of the lamina is made from a material selected from the group consisting of metals, metal alloys, polymers, composites, stainless steel, carbon steel or phosphor bronze, and mixtures thereof.

85. (Previously presented) The method according to claim 73 where the device is selected from the group consisting of micromechanical systems, microelectromechanical

systems, miniature energy and chemical systems, microthermal systems, microthermomechanical systems, cryocoolers, alpha-Stirling coolers, heat pumps, compressors, thermal compressors, refrigerators, heat engines, valves, nozzled valves, ink-jet print-head valves, fuel cells, fuel combustors, fuel processors, and systems comprising one or more of these devices.

86. (Previously presented) The method according to claim 73 where the device or a component of a device is meso-scale.

87. (Previously presented) A method for making a micro- or meso-scale device or a component of such a device comprising:

providing three or more laminae that coupled together collectively define a device or a component of a device;

registering the laminae to define at least one internal lamina, positioned between a first and a second lamina, the at least one internal lamina having a structure and at least one substructure coupled to the structure or another substructure by at least one fixture bridge made of a non-refractory material;

bonding the laminae one to another to form a monolithic device or a component of a device; and

eliminating the fixture bridge prior or subsequent to bonding the laminae by applying an electrical potential across the fixture bridge.

88. (Previously presented) The method according to claim 87 further comprising:

filling the space between a structure and a substructure with a fixative prior to eliminating the fixture bridge;

dissociating at least one substructure from the structure to which it is coupled by eliminating the fixture bridge; and

eliminating the fixative.